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Summary and Implications

Trailers used to transport market weight pigs in the U.S. are passively ventilated meaning airflow is dependent upon vehicle movement, thermal buoyancy, and wind speed. Research detailing the trailer micro-environment in the U.S. is sparse. The amount of bedding on a trailer and the number of loads on it are believed to influence trailer microenvironment. Using 2011 data for number of pigs transported, industry standards for density of pigs inside a trailer, and the average cost of bedding an estimated annual cost of bedding can be made. If new bedding were put on trailers after every load it is estimated to cost between $13 and $26 million dollars annually. Again, using 2011 data and using national average cost of washout an estimated annual cost to washout the trailer can be made. Trailer washout adds between $8 and $108 million to the cost of bedding. When the micro-environment exceeds a pig's thermal comfort zone transport losses can result. Transport losses, the sum of dead on arrival and non-ambulatory, are difficult to estimate because non-ambulatory pigs are not tracked nationally. Dead on arrival are estimated to cost ~ $29 million annually.

Introduction

In the (United States (U.S.), published research detailing the micro-environment inside trailers transporting market weight pigs is sparse. Additionally, studies from the European Union are difficult to transpose to the U.S. because of major differences in trailer designs. Trailers in the U.S. are passively ventilated, meaning that airflow is dependent upon thermal buoyancy, the movement of the vehicle, and wind speed. Bedding levels may influence the trailer's micro-environment by providing insulation and absorbing moisture from pig waste. The Transport Quality Assurance (TQA) program, published by the National Pork Board, states that "… *[the] trailer should be washed, disinfected, and completely dried after being unloaded…[and] weather appropriate bedding [should be added]*" (page 30 and 16 respectively; TQA) The amount- and number of times bedding is reused may result in an inappropriate trailer micro-environment that, in turn, may detrimentally affect transport losses. Transport losses are the sum of non-ambulatory (NA) and dead on arrival (DOA) pigs. Non-ambulatory pigs can include both injured and fatigued. Transport losses are an economic and swine well-being challenge for the U.S. swine industry. Therefore, the objective of this study was to quantify the cost of bedding, trailer washout, and transport losses in market weight pigs using data from 2011.

Methods

The following calculations provide a guide for bedding, trailer washout, and transport loss predicted costs based on 2011 data for the U.S. swine industry. The calculations can be manipulated to meet individual needs.

Bedding Costs

Average number of pigs transported per trailer: According to TQA, market weight pig (pigs weighing between 113.4 and 136.1 kg) should be given between 0.32 and 0.44 m^2 per pig. In 2011, the National Agriculture and Statistic Service (NASS) estimated the average weight of market pigs was 124.7 kg.

Pig density per trailer / average floor space on trailers
= average number of pigs transported per trailer

(71.3 m^2 per trailer) / (0.32 m^2 per pig)
= 222.8 pigs per trailer

(71.3 m^2 per trailer) / (0.44 m^2 per pig)
= 162.0 pigs per trailer

(222.8 + 162.0) / 2
= 192.4 average number of pigs transported per trailer

Loads of market weight pigs: The NASS reported 109,956,300 market weight pigs were transported to processing facilities in 2011.

number of pigs processed / average number of pigs per trailer
= loads of market weight pigs

(109,956,300 pigs) / (192.4 average pigs per trailer)
= 571,498.44 loads of market weight pigs

Bedding costs: Three - and six bags of bedding were chosen because three bags of bedding barely covers- and six bags completely cover the trailer floor. Wood shavings, based on field experience, are readily used and widely available. Prices from several sources (bestwoodshavings.com, outdoorpros.com, camping.cs7warehouse.net, farm-home.com) were averaged to provide a cost for a 0.2 m^3 (22.7 kg) bag of wood shavings. Each of these sources provided the cost for different sizes of wood shavings in ft^3 so a conversion to m^3 needed to be conducted:

(ft^3 per bag) * (m^3 per ft^3)
= m^3 per bag

(8.5 ft^3) * (0.028 m^3 per ft^3) = 0.24 m^3 per bag

(9.5 ft^3) * (0.028 m^3 per ft^3) = 0.27 m^3 per bag

(11 ft^3) * (0.028 m^3 per ft^3) = 0.31 m^3 per bag

[(cost per bag) / (m^3 per bag)] *0.2 m^3
= cost per 0.2 m^3 bag

($7.00/0.24 m^3) * 0.2 m^3 = $5.83

($6.75/0.27 m^3) * 0.2 m^3 = $5.00

($14.14/0.31 m^3) * 0.2 m^3 = $9.12

($16.31/0.31 m^3) * 0.2 m^3 = $10.52

(sum of cost per bag) / (number of sources)
= average cost per 0.2 m^3 bag

($5.83 + $5.00 + $9.12 + $9.12+ $10.12)/5
= $7.84 average cost per 0.2 m^3 bag of bedding

Annual cost of bedding trailers:

(average cost per bag) * (3 bags) * (number of loads transported)

= cost of using 3 bags

$7.84 * 3 bags * 571,498.44

= $13,442,000 annual cost of bedding trailers using 3 bags

(average cost per bag)* (6 bags) * (number of loads transported)

= cost of using 6 bags

($7.89) * 6 *571, 498.44

= $26,883,000 annual cost of bedding trailers using 6 bags

Trailer Washout Costs

For biosecurity reasons, TQA recommends washing out livestock transport trailers after each load. Practically, this involves the removal of all bedding followed by disinfecting the trailer per company protocol. With the highest ($190) and lowest ($15) fees reported (livestocknetwork.com), for using washout facilities in the U.S., the annual cost of washout can be estimated.

(lowest washout price) * (number of loads transported)

= lowest cost of washout

(571,498.44 loads) * ($15)

= $8,572,000 lowest cost of washout

(highest washout price) * (number of loads transported)

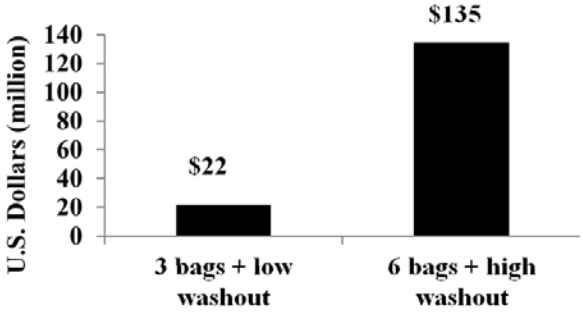
= highest cost of washout

(571,498.44 loads) * ($190)

= $108, 585,000 highest cost of washout

The cost of washout is compounded by the need to re-bed the trailer after. The total cost of washout and re-bedding can be seen in Figure 1.

Figure 1. Total cost ($) for bedding and washout



Transport Loss Costs

Non-ambulatory pigs are not recorded by the Food Safety Inspectors Service (FSIS). Therefore, for this report NA losses will not be included in transport loss costs.

Number of DOA pigs/load: Based on the number of pigs marketed, number of loads, and the number of DOA pigs in 2011 the number of DOA pigs per load can be calculated:

(percent DOA) * (number of pigs marketed)

= dead pigs

(0.15 %) * (109,956, 300 pigs)

= 164,934.45 dead pigs

(number of dead pigs)/(number of loads)

= dead pigs per load

(164,934.45) / (571,498.44)

= 0.29 dead pigs per load

Cost per dead market weight pig: In 2011, NASS reported the average price per cwt (aka price per 100 lbs. of pig or 45.4 kg of pig) was $66.50. The cost of each DOA (or average price per head) can be calculated from the cwt price and the average market pig weight:

(average weight of pigs marketed) * (price per 45.4 kg)
= Price per pig

(124.7 kg) * ($66.50/ 45.4 kg) = $178 per pig

Assuming dead pigs are a loss, the annual cost of dead pigs can be estimated:

Cost of DOA pigs annually:

(number of dead pigs) * (cost/ dead pig)

= cost of dead pigs

(164,934.45 dead pigs) * ($178 / dead pig)

= $29,358, 000 cost of DOA at the plant

Discussion

Using these calculations and 2011 data, it is predicted that bedding, washout, and transport losses cost the U.S. swine industry between:

- $13- and $26 million annually for bedding after each load
- $8- and $108 million annually for trailer washout after each load
- $29 million for DOA

However, the estimate for trailer washout is likely under budgeted as additional costs were not considered. These additional costs might include recycling water or lost income to truckers while washout occurs. The cost of transport losses are potentially under budgeted because NA was not included. Based on the most cost prohibitive estimates (six bags of bedding on every trailer and washing out at the most costly facility after every load) the annually, washout and bedding costs the U.S. swine industry $135 million annually. Therefore, it is strongly advised that a cost benefit analysis should be performed to determine whether, pig well-being is improved with trailer washout and reapplication of new bedding after every load.

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